A METHOD AND SYSTEM FOR EFFICIENTLY EVALUATING AND DRAWING NURBS SURFACES FOR 3D GRAPHICS

CLAIMS

What is claimed is:

1. In a computer system having a processor, a bus, and a graphics rendering pipeline for displaying 3D graphics on a display, a computer implemented method for rendering a curve or a surface, the method comprising the computer implemented steps of:

a) receiving a NURBS model for rendering from a software program running on the processor of the computer system ;

b) converting the NURBS model to a Bezier model using the graphics rendering pipeline;

c) generating a plurality of points on a curve or surface, wherein the curve or surface is defined by the Bezier model, using the graphics rendering pipeline; and

d) rendering the curve or surface using the plurality of points and using the graphics rendering pipeline.

2. The method of claim 1 wherein step a) further includes the step of receiving the NURBS model in the graphics rendering pipeline via the bus, wherein the NURBS model defines all of a curve or surface, or a portion of the curve or surface, to be rendered.

3. The method of claim 1 wherein step b) further includes the step of generating a plurality of Bezier control points from a corresponding plurality of NURBS control points.

4. The method of claim 3 further including the step of using a tri-linear interpolator to generate the plurality of Bezier control points from the corresponding plurality of NURBS control points.

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5. The method of claim 4 further including the steps of:

using the plurality of NURBS control points as inputs to the tri-linear interpolator; and

evaluating the NURBS control points to obtain each of the plurality of Bezier control points.

6. The method of claim 1 wherein step c) further includes the step of generating a plurality of points on the curve or surface using a plurality of Bezier control points.

7. The method of claim 6 further including the steps of:

using the plurality of Bezier control points as inputs to a tri-linear interpolator; and

evaluating the plurality of Bezier control points to obtain the plurality of points on the curve or surface.

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8. The method of claim 1 further including the steps of:

processing the plurality of points with the graphics rendering pipeline;

rendering the curve or surface with the graphics rendering pipeline; and

rendering the curve or surface with the graphics rendering pipeline.

9. In a graphics rendering pipeline of a computer system, a method for rendering curves or surfaces using the graphics rendering pipeline, the method comprising the steps of:

a) implementing a de Casteljau process in the graphics pipeline;

b) evaluating a Bezier curve or surface using the de Casteljau process; and

c) rendering the Bezier curve or surface.

10. The method of claim 9 further including the step of implementing the de Casteljau process using a tri-linear interpolator included in the graphics pipeline.

11. The method of claim 9 further including the steps of:

loading inputs of the tri-linear interpolator with a plurality of control points of the Bezier curve or surface; and

generating a plurality of points on the curve or surface using the tri-linear interpolator.

12. The method of claim 11 further including the step of using the plurality of points to render the Bezier curve or surface.

13. In a graphics rendering pipeline of a computer system, a method for converting a NURBS (non-uniform rational B-spline) curve or surface to a Bezier curve or surface using the graphics rendering pipeline, the method comprising the steps of:

a) loading a plurality of NURBS control points of a NURBS curve or surface into the graphics rendering pipeline;

b) evaluating the plurality of control points into a resulting plurality of Bezier control points;

c) generating a Bezier curve or surface using the resulting plurality of Bezier control points; and

d) rendering the Bezier curve or surface using a plurality of vertices derived from the plurality of Bezier control points.

14. The method of claim 13 further including the steps of:

loading the plurality of NURBS control points into inputs of a tri-linear interpolator included in the graphics rendering pipeline; and

evaluating the plurality of NURBS control points into the resulting plurality of Bezier control points using the tri-linear interpolator.

15. The method of claim 13 further including the step of transforming the NURBS curve or surface from a global domain to a local domain.

16. In a graphics rendering pipeline of a computer system, a method for generating normal vectors (normals) for a surface, the method comprising the steps of:

a) generating a plurality of surface partials from the surface using the graphics rendering pipeline;

b) generating a plurality of surface tangents from the plurality of surface partials using the graphics rendering pipeline; and

c) generating at least one normal from the plurality of surface tangents using the graphics rendering pipeline.

17. The method of claim 16 further including the steps of:

loading inputs of a tri-linear interpolator included in the graphics rendering pipeline with a plurality of Bezier control points defining the surface; and

evaluating the plurality of Bezier control points to generate the plurality of surface partials.

18. The method of claim 16 further including the step of generating the plurality of surface tangents from the plurality of surface partials using a blender included in the graphics rendering pipeline.

19. The method of claim 18 further including the step of generating the at least one normal from the plurality of surface tangents using the blender.

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20. In a graphics rendering pipeline of a computer system, a method of using the graphics rendering pipeline to render a curve or surface directly from a NURBS (non-uniform rational B-spline) model, the method comprising the steps of:

a) performing a global to local transformation on a NURBS model using the graphics rendering pipeline;

b) evaluating a plurality of NURBS control points using the graphics rendering pipeline to obtain a plurality of points on a curve or surface defined by the NURBS model; and

c) rendering the curve or surface using the plurality of points.

21. The method of claim 20 further including the step of indexing at least one look up table within the graphics rendering pipeline to perform the global to local transformation of the NURBS model.

22. The method of claim 21 further including the step of evaluating the plurality of NURBS control points using a tri-linear interpolator included in the graphics rendering pipeline.

23. The method of claim 22 further including the step of indexing the at least one look up table with the graphics rendering pipeline to obtain a plurality of parameters to configure the tri-linear interpolator;

24. The method of claim 23 further including the steps of:

implementing a quadri-linear interpolator using said tri-linear interpolator; and

generating the plurality of control points using said quadri-linear interpolator.

25. The method of claim 20 wherein step b) further includes the steps of:

using the graphics rendering pipeline to implement a convolution; and

using the convolution to obtain the plurality of points on the curve or surface.